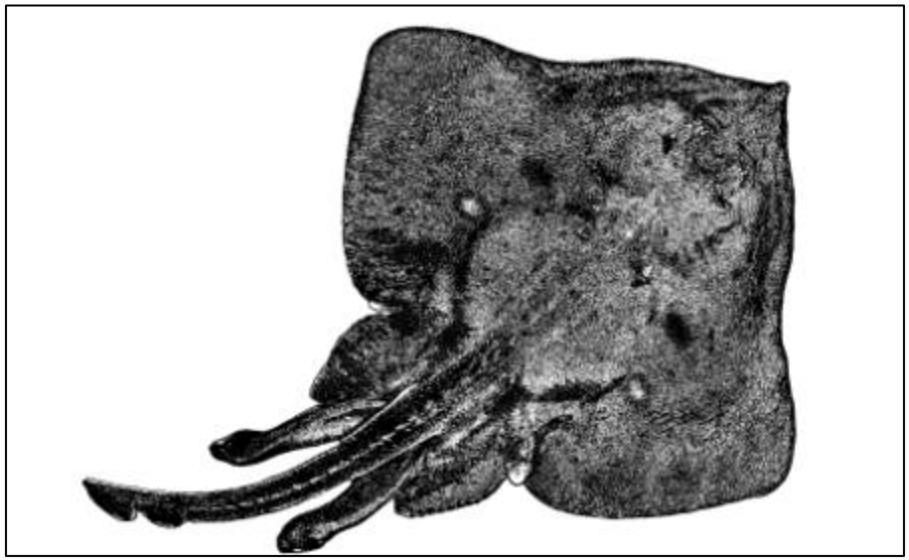
revised model for the Alaska skate in the BSAI



Olav A. Ormseth
Alaska Fisheries Science Center
NPFMC Groundfish Plan Team meeting, September 2012

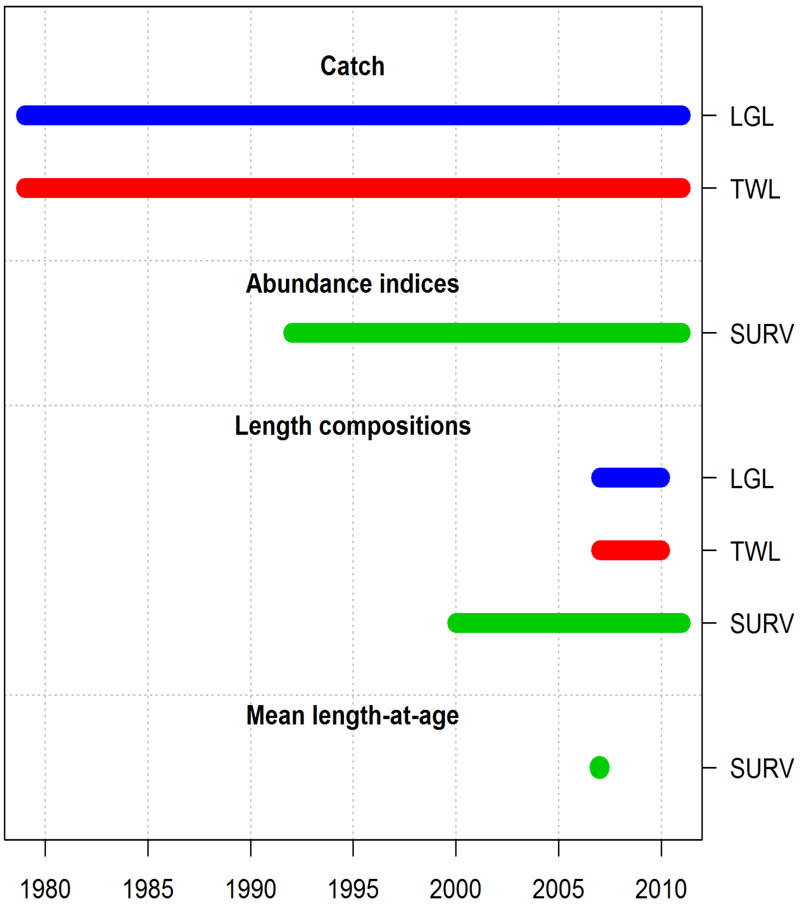
overview

- why revise the model?
- changes
- evaluation
- results

why change the model?

- existing model doesn't do well at length-at-age
- existing model doesn't take advantage of new SS features
- the SSC said so

data



Catch
LGL
TWL
Abundance indices
SURV
Length compositions
LGL
TWL
SURV
Mean length-at-age
SURV
1980
1985
1990
1995
2000
2005
2010

methodology kept intact

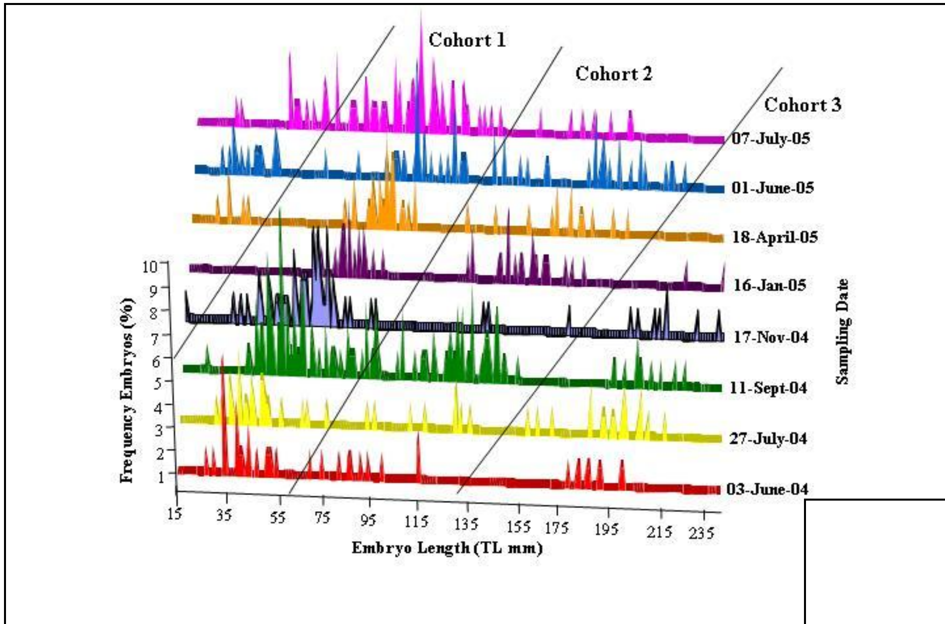
- **3-year embryonic period included in model**

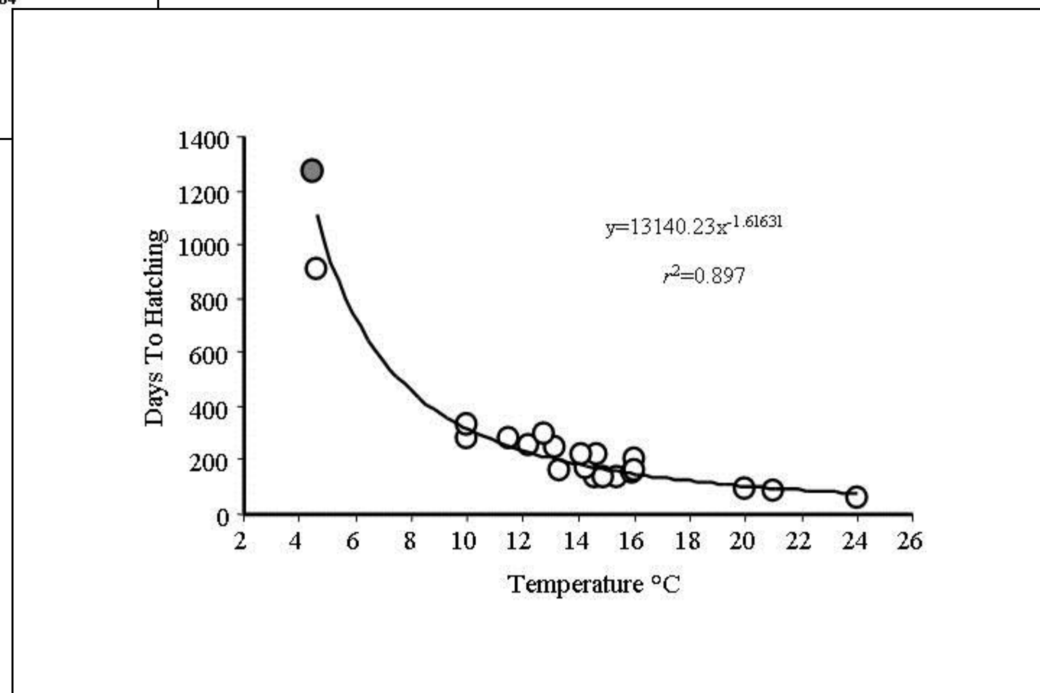
- **fixed M of 0.13**

- **fixed maturity, fecundity, etc.**

- **fixed survey catchability of 1**

review of embryo period





changes in methodology

- used an updated version of Stock Synthesis (version 3.23)
- 4-parameter Schnute growth function used to model growth, instead of 3-parameter von Bertalanffy
- parameters of growth model estimated independently and fixed
- selectivity functions for both fisheries and the survey are dome-shaped rather than asymptotic.
- “survivorship” function is used to model the stock-recruit relationship.
- knife-edge age selectivity fixed at 3.5 for all fisheries % survey
- maximum age was raised from 25 to 30.
- model starts in 1980

growth model

- changed from LVB to Schnute 4-parameter
- approximated Gompertz by using low value of ϒ
- parameters estimated independently, then fixed
- CV estimated within the model

$$Y(t) = \left\{ y_1^{\gamma} + \left(y_2^{\gamma} - y_1^{\gamma} \right) \frac{1 - exp[-\kappa(t - \tau_1)]}{1 - exp[-\kappa(\tau_2 - \tau_1)]} \right\}^{1/\gamma}$$

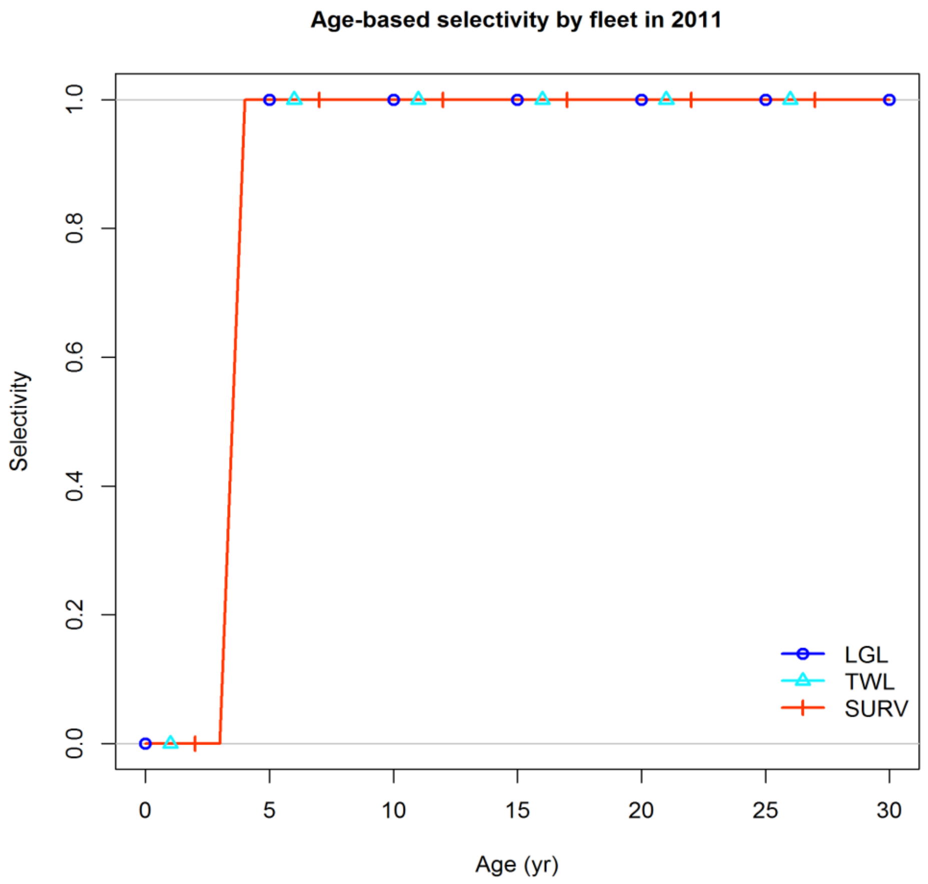
- y1 & y2 = size at ages τ1 and τ2
- κ = von Bertalanffy growth parameter
- ϒ = Richards coefficient

length selectivity

- abandoned fixed logistic selectivity for survey (didn’t describe all aspects of survey selectivity)
- both fisheries & survey are double normal (recommended in SS)
- initial values & resulting estimated parameters are for dome =shaped selectivity
- descending limb consistent with inhabitation of skate nursery sites by older, larger skates & resulting unavailability
- peak of selectivity curve (i.e. double-normal parameter #1) fixed; all other parameters estimated

age selectivity

- knife-edged age selectivity at 3.5 years for both fisheries & survey



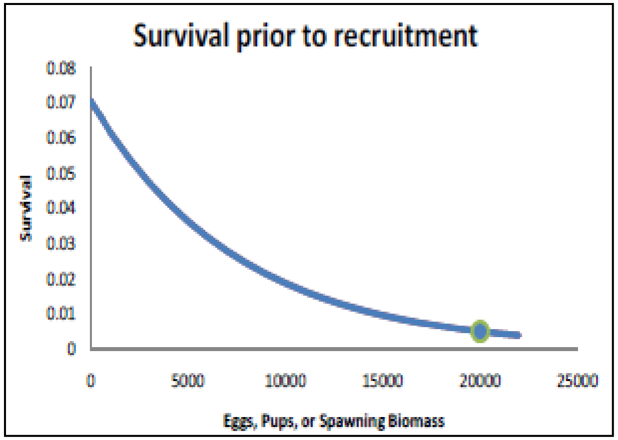
survivorship function

- three-parameter function

- R_0

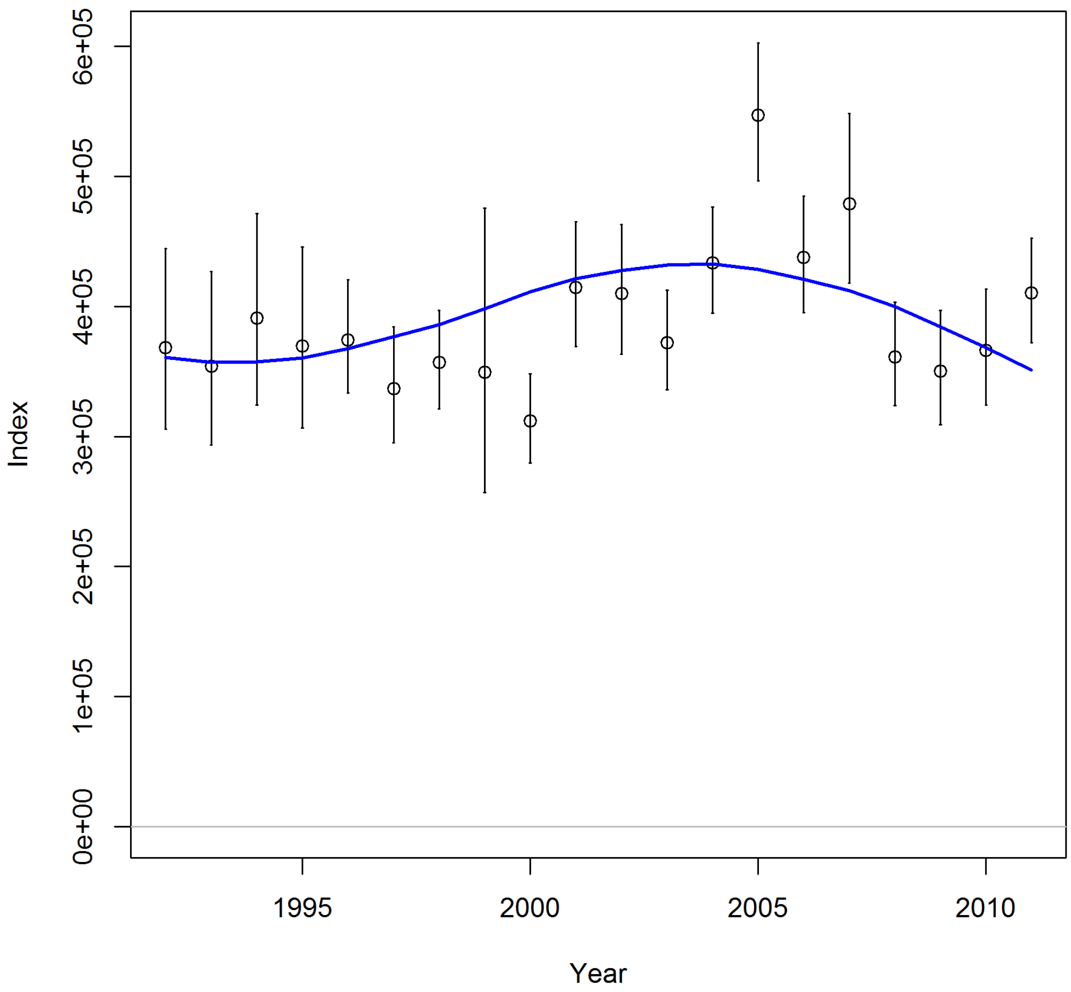
- Z_{frac} ~ increase in survival rate with reduced spawning stock size

- β ~ controls where survival changes fastest as a function of spawning depletion (i.e. controls the shapes of the curve)



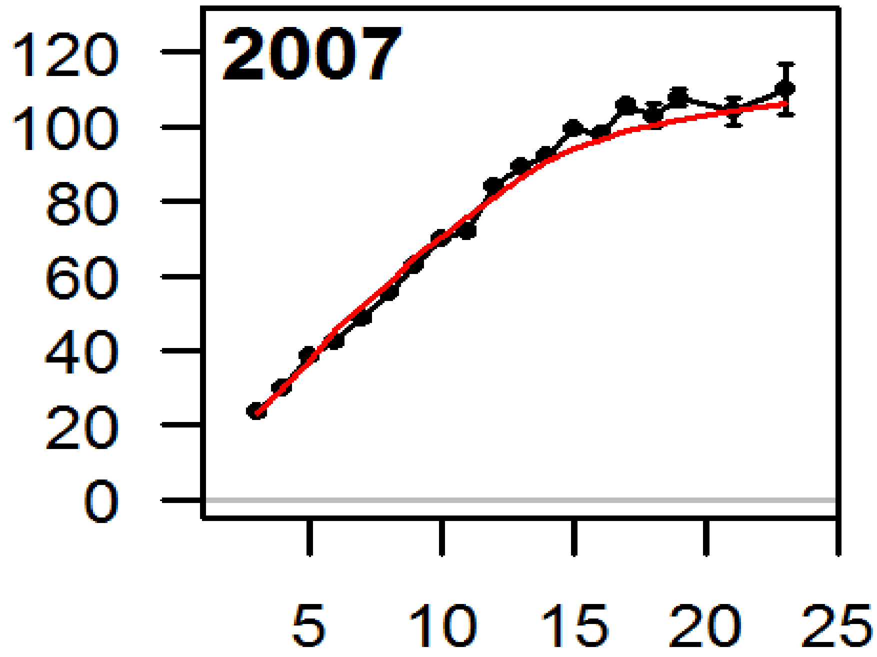
Zfrac = 0.5
B = 1.0

survey fit

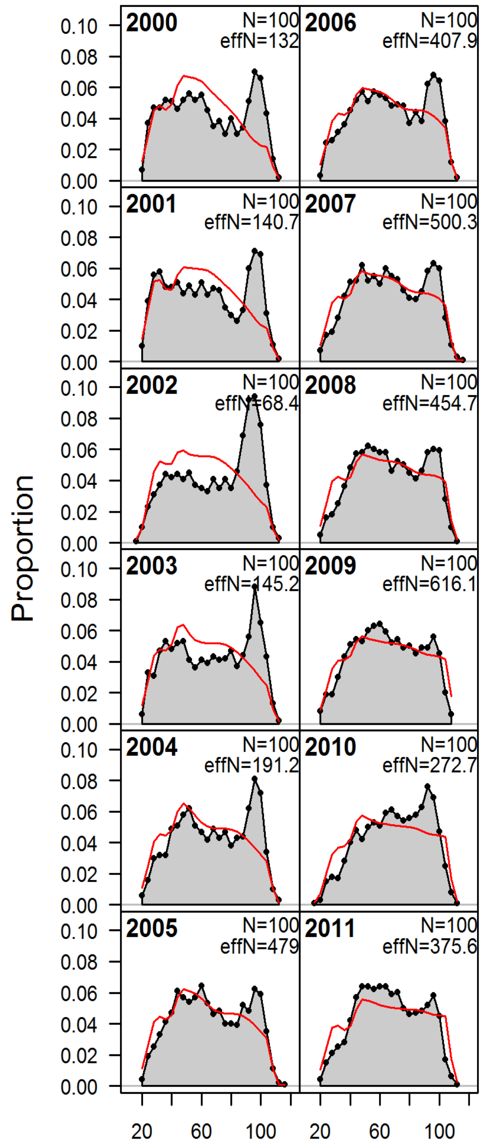


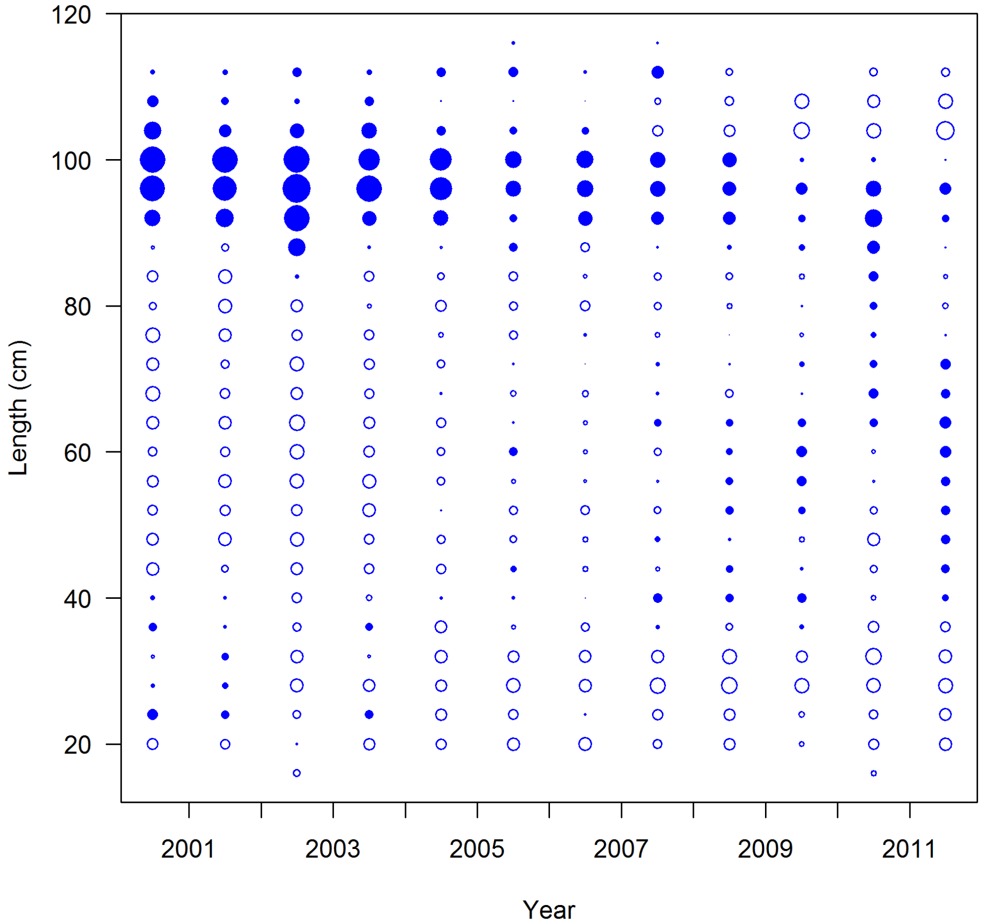
Index
Year
0e+00
1e+05
2e+05
3e+05
4e+05
5e+05
6e+05
1995
2000
2005
2010

model fit to LAA

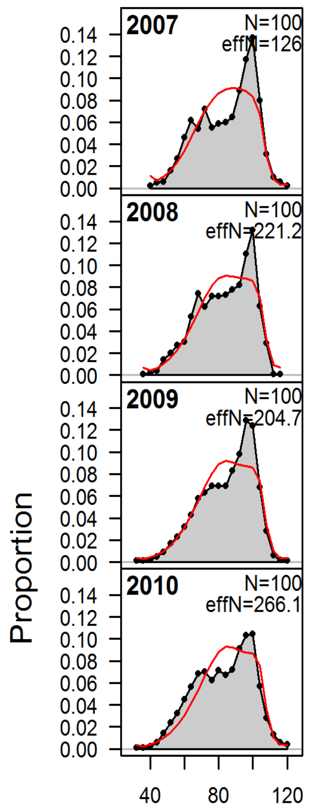


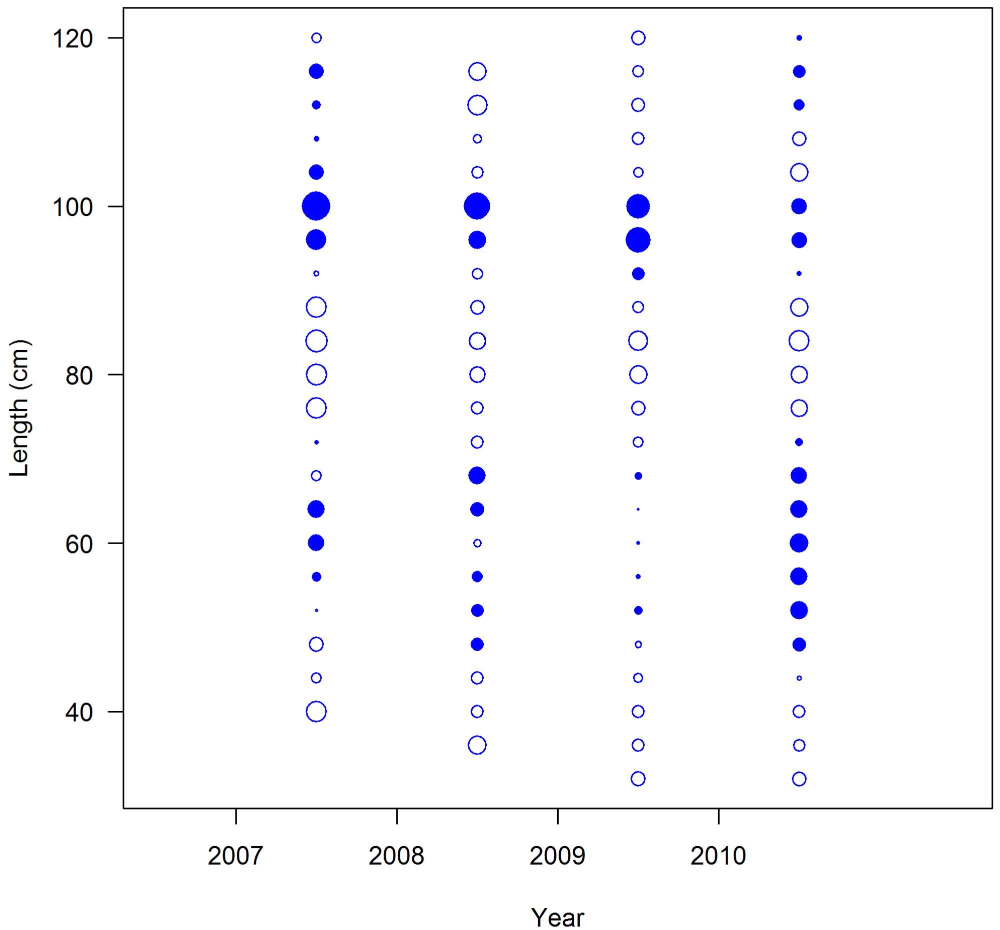
survey length comps



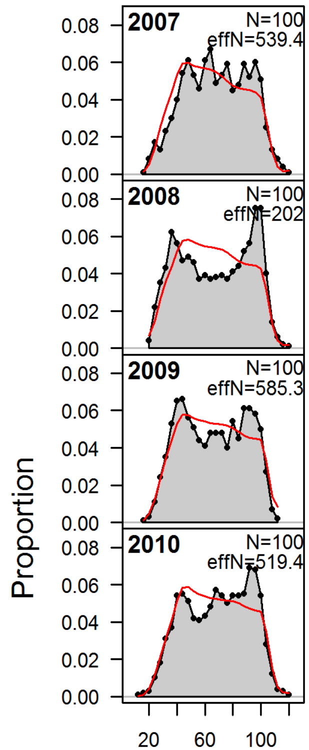


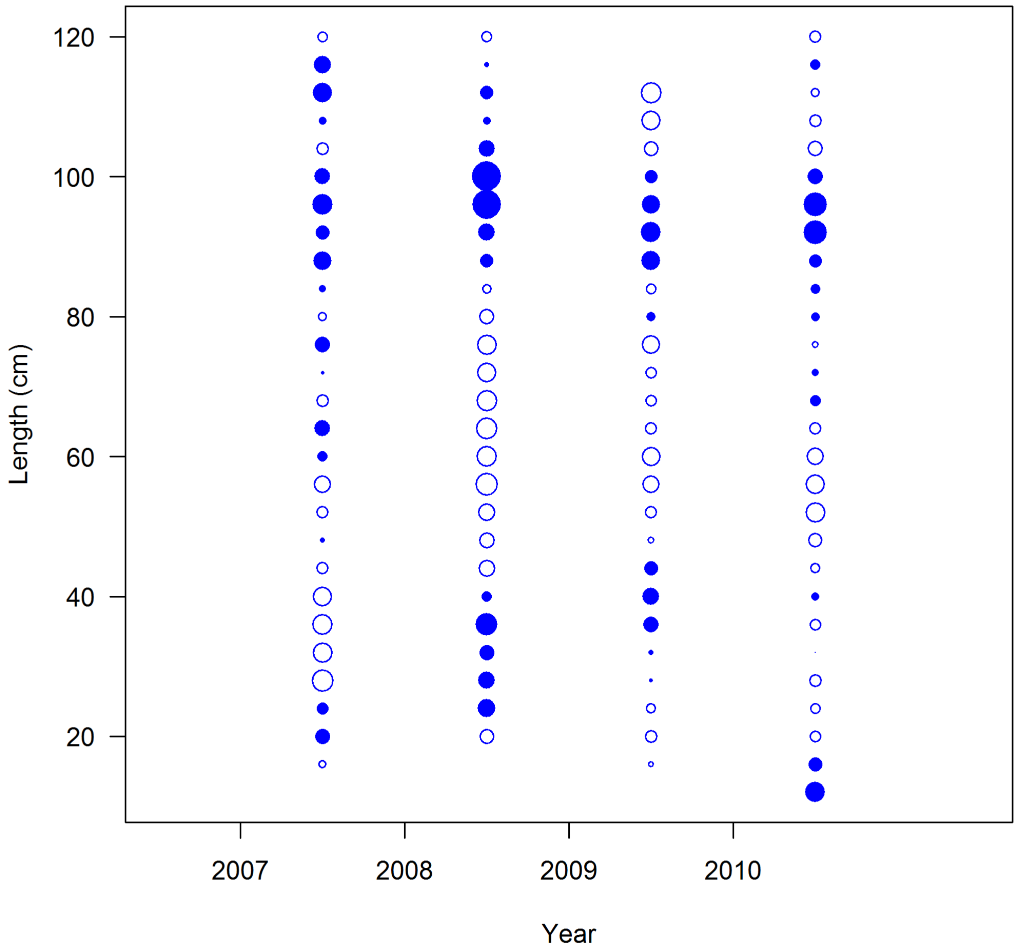
longline length comps



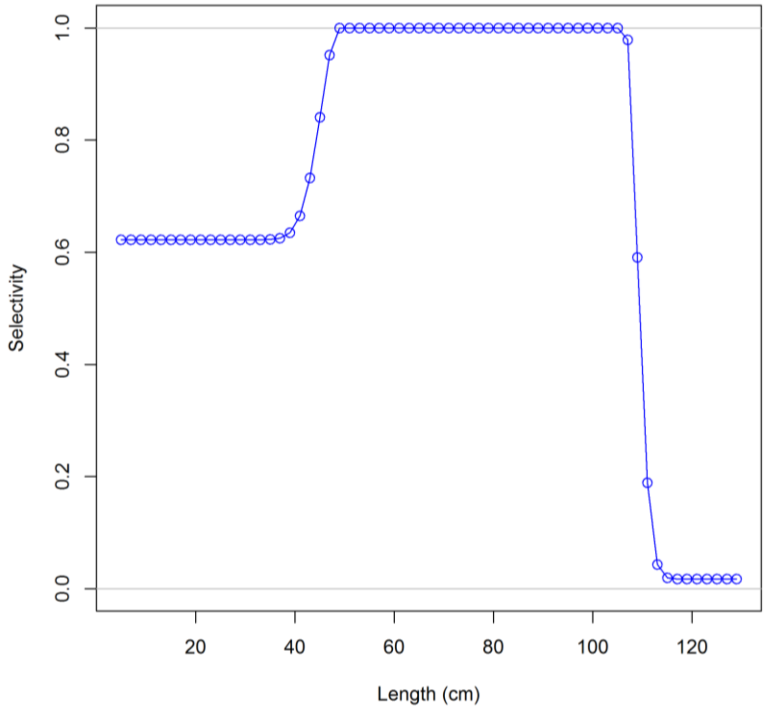


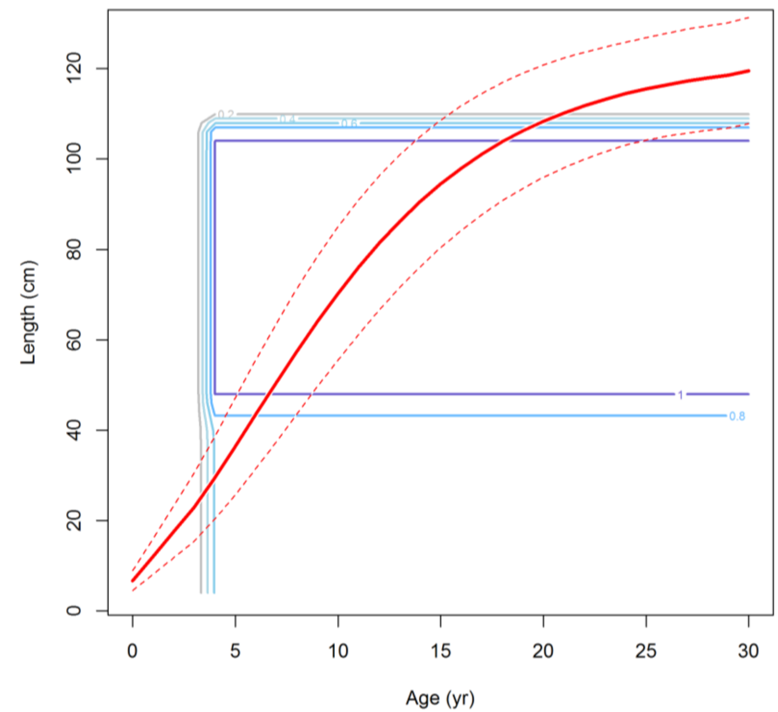
trawl length comps



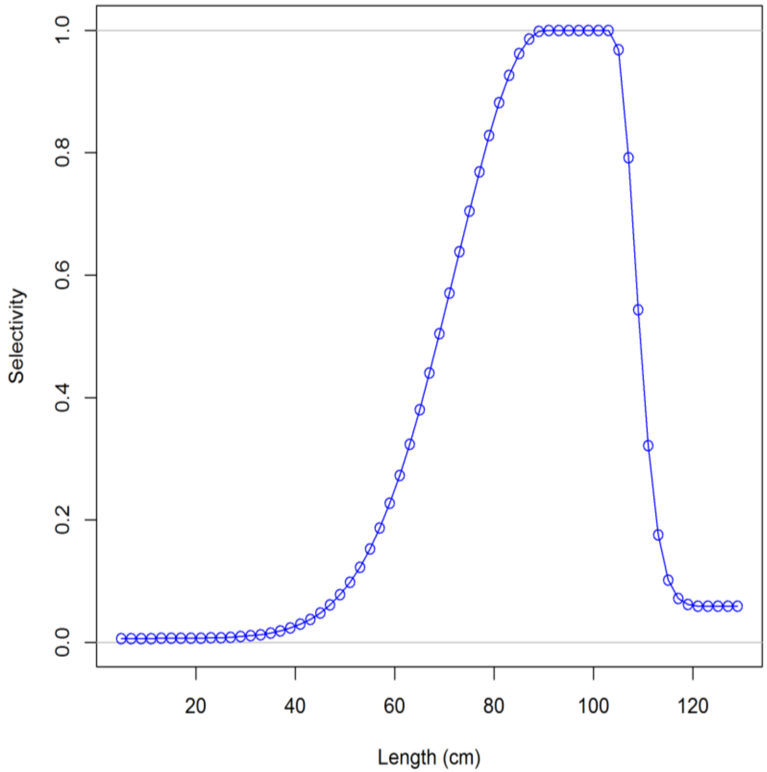


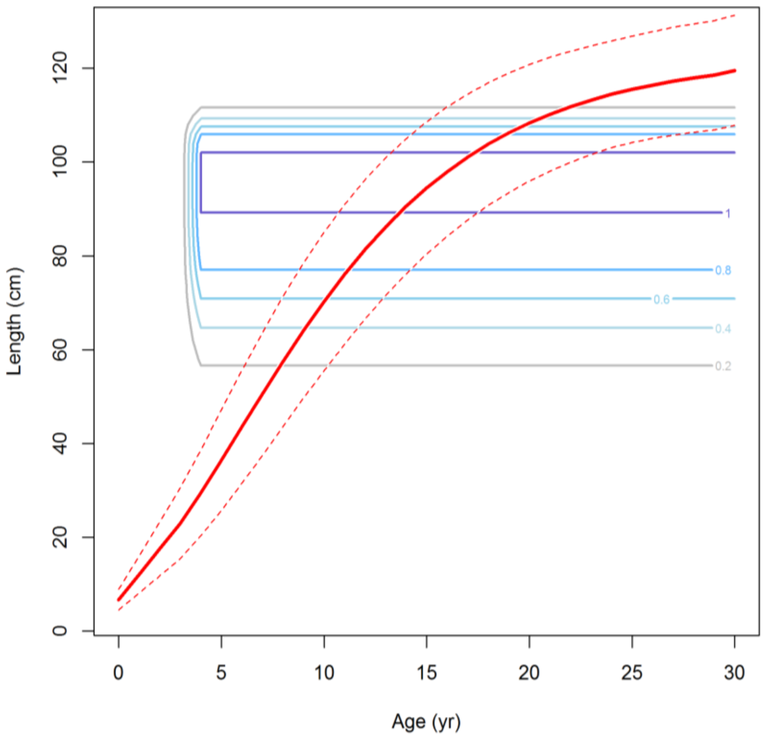
survey selectivity



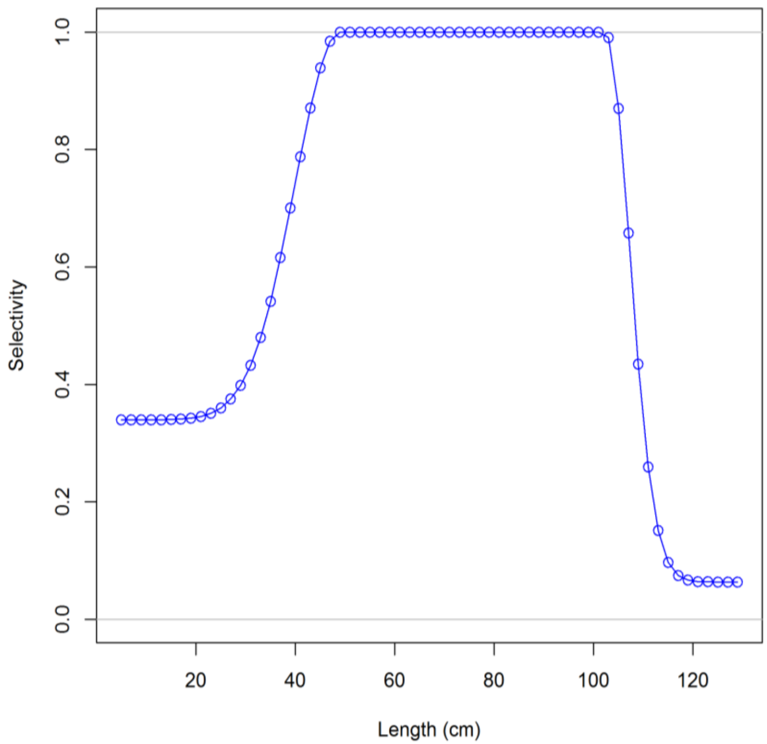


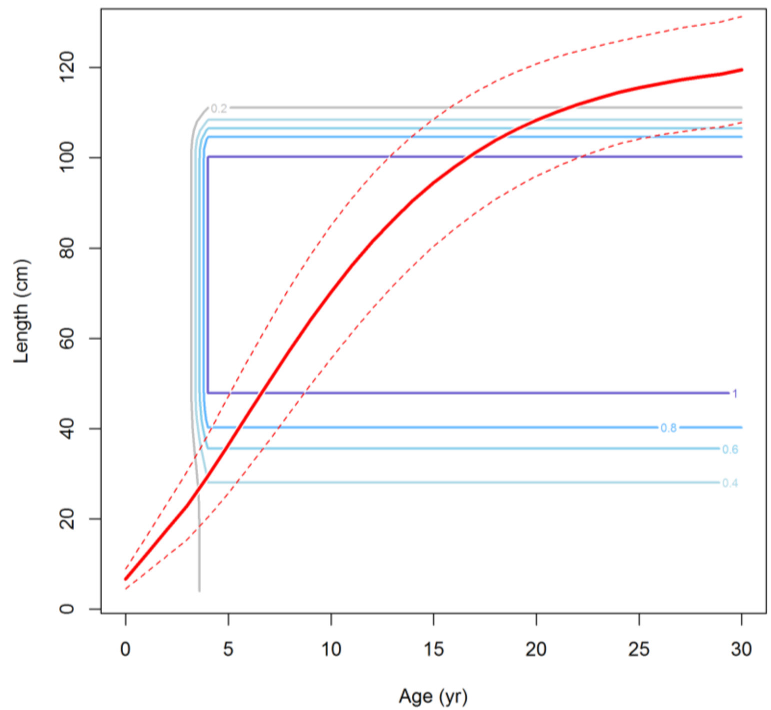
longline selectivity



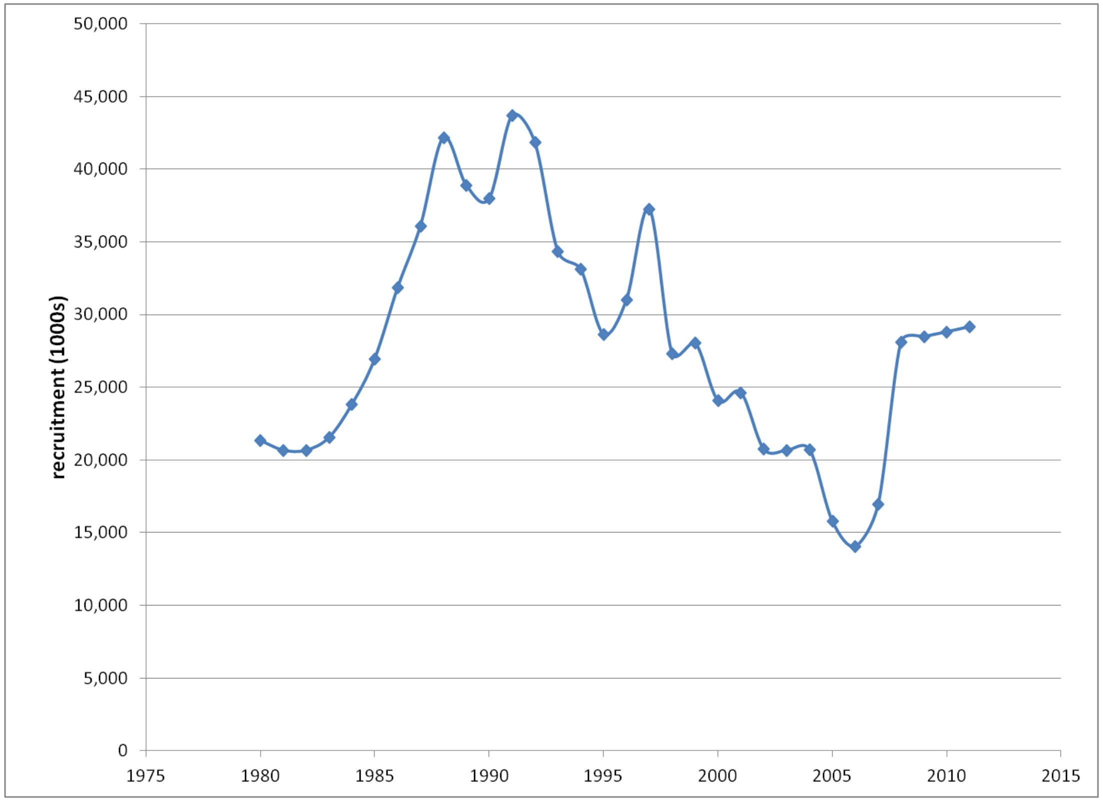


trawl selectivity

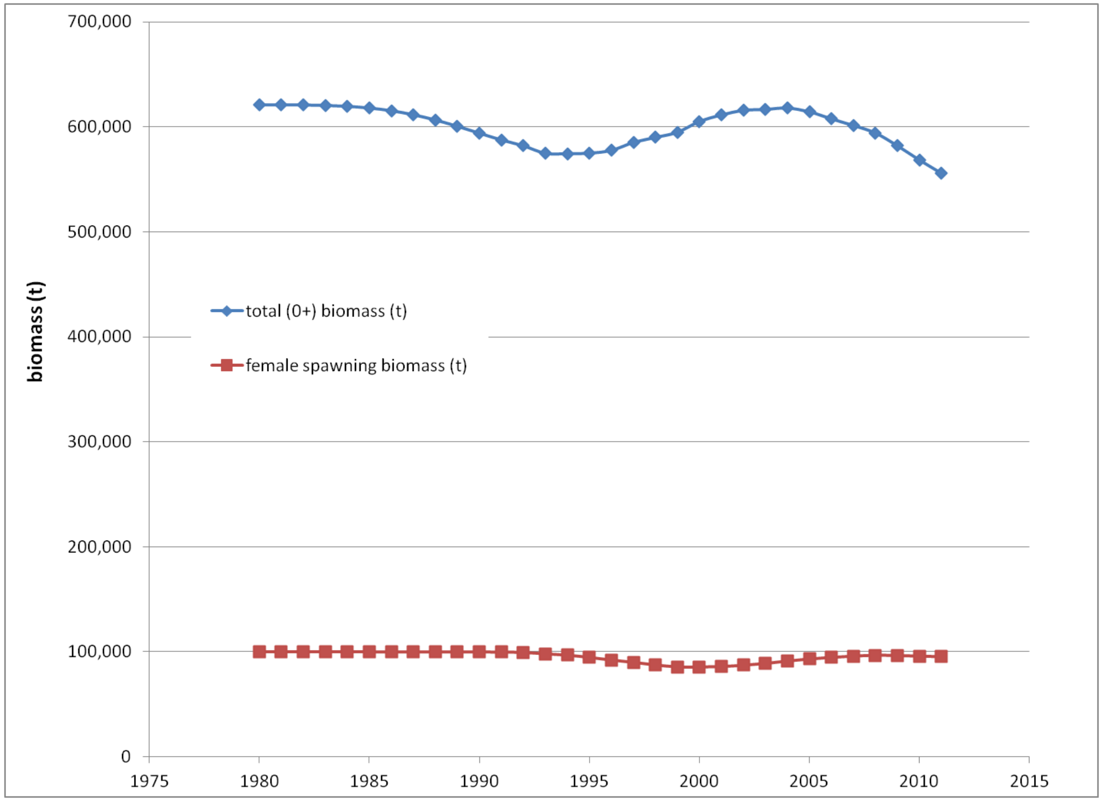




recruitment estimates



population estimates



comparing reference points etc.

quantity	existing model values for 2012	**revised model values for 2012**
M (natural mortality rate)	0.13	0.13
Tier	3a	3a
Projected total (age 0+) biomass (t)	550,912	**594,827**
Female spawning biomass (t)		
Projected	55,139	**89,366**
$B_{100\%}$	92,117	**116,911**
$B_{40\%}$	36,846	**46,764**
$B_{35\%}$	32,241	**40,919**
F_{OFL}	0.087	**0.10**
max F_{ABC}	0.075	**0.089**
F_{ABC}	0.075	**0.089**
OFL (t)	29,669	**32,254**
max ABC (t)	25,565	**28,158**
ABC (t)	25,565	**28,158**
Status		
Overfishing	No	**No**
Overfished	No	**No**
Approaching overfished	No	**No**